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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B02C 21/02 — A1

(11) International Publication Number: **WO 99/54049**

(43) International Publication Date: 28 October 1999 (28.10.99)

(21) International Application Number: PCT/GB99/01210

(22) International Filing Date: 22 April 1999 (22.04.99)

(30) Priority Data:

9808468.4	22 April 1998 (22.04.98)	GB
9810807.9	20 May 1998 (20.05.98)	GB

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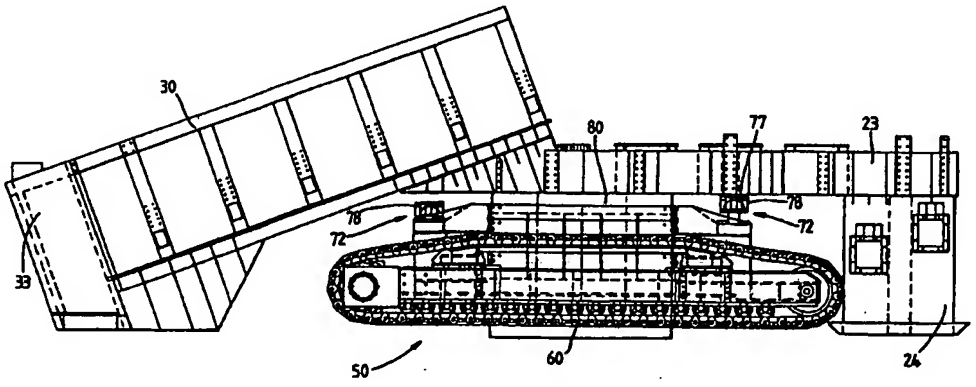
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: A MINERAL BREAKER APPARATUS



(57) Abstract

A mineral breaking apparatus including a rigid support chassis (20) having an elevated section (23) supported above the ground by at least three ground contacting regions (24, 27), the apparatus including a mineral breaker (12) mounted on said elevated section (23) and a feed conveyor (11) for feeding mineral to be broken to the mineral breaker (12), the chassis including an inclined section (21) having a lower end (27) and an upper end, the lower end being adapted to define one of said at least three ground engaging regions and the upper end being connected to said elevated section (23), said elevated section defining a support for said feed conveyor, and at least two ground engaging feet (24) mounted on the elevated section to define two of said ground contacting regions.

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A MINERAL BREAKER APPARATUS

The present invention relates to a mineral breaker apparatus, in particular but not exclusively, a mineral breaker apparatus or rig for open cast mining.

In open cast mining operations mineral is mined in large quantities using large scoops or buckets which deposit the won material into large trucks for transportation to mineral breaking machines which reduce the mineral from large lumps into smaller maximum sized lumped capable of being transported away by conveyors. Typically, in open cast mining operations, the mineral breaker is required to handle throughputs of about 20,000 tons.

Certain types of mineral breaking machinery such as gyratory mineral breakers are very large static structures which typically require a long time to install. Such structures require specially constructed foundations and once installed cannot be readily moved. Accordingly, it is necessary for the loading trucks to travel from the area in the open cast mine where mineral is being extracted to the breaker. This can involve the trucks traveling long distances. Accordingly in order to keep both the loading buckets and breaker fully utilised it is necessary to have a large number of trucks for transporting the mineral in a constant stream between the loading buckets and breaker. It will be appreciated that such installations are extremely expensive and inflexible to the operating needs of an open cast mine.

In particular, as the mining area recedes from the gyratory breaker it is necessary for the loading trucks to travel ever increasing distances and so

reduces the efficiency of the mining operation. In practice, this can only be remedied by increasing the number of trucks due to the length of time and expense necessary for re-siting the gyratory breaker.

The present invention aims to provide a mineral breaking apparatus or rig capable of handling the large throughput tonnages associated with open cast mining but which is easily transported for assembly on site and which may be easily converted from a static rig to a fully mobile rig thereby enabling the rig to be easily re-sited without the need for dismantling.

According to one aspect of the present invention there is provided a mineral breaking apparatus including a rigid support chassis having an elevated section supported above the ground by at least three ground contacting regions, the apparatus including a mineral breaker mounted on said elevated section and a feed conveyor for feeding mineral to be broken to the mineral breaker, the chassis including an inclined section having a lower end and an upper end, the lower end being adapted to define one of said at least three ground engaging regions and the upper end being connected to said elevated section, said elevated section defining a support for said feed conveyor, and at least two ground engaging feet mounted on the elevated section to define two of said ground contacting regions.

Preferably the elevated section of the chassis is adapted to detachably receive a mobile transport unit which is capable of raising the apparatus clear of the ground, the mobile drive unit having ground engaging tracks or wheels which are drivingly driven for transporting the apparatus from one location to another location.

Various aspects of the present invention are hereinafter described with reference to the accompanying drawings, in which:-

Figure 1 is a schematic perspective view from above, one side and the rear of a first embodiment according to the present invention;

Figure 2 is a schematic perspective view of the first embodiment from above, the opposite side and the front;

Figure 3 is a schematic side view of the first embodiment shown in an operating condition;

Figure 4 is a similar view to Figure 3 showing the first embodiment in a mobile condition;

Figure 5 is a plan view of the first embodiment;

Figure 6 is a broken away front view of the first embodiment;

Figure 7 is a broken away plan view illustrating the basic load carrying chassis of the first embodiment;

Figure 8 is a sectional view taken along line VIII-VIII in Figure 7;

Figure 9 is a side view of the chassis shown in Figure 7;

Figure 10 is a plan view of the mobile traction unit;

Figure 11 is a side view of the traction unit shown in Figure 10;

Figure 12 is an end view, partly in section, of the traction unit shown in Figure 10;

Figure 13 is a plan view of a second embodiment according to the present invention;

Figure 14 is a side view of the second embodiment; and

Figure 15 is a front view of the second embodiment.

Referring initially to Figures 1 to 12 there is shown a mineral breaking apparatus or rig 10 according to a first embodiment of the invention.

The rig 10 includes a feed conveyor 11, a mineral breaker 12 and a takeaway conveyor 14.

The feed conveyor 11 is inclined and feeds mineral to be broken to an elevated position above the mineral breaker 12 and deposits the feed mineral into the mineral breaker 12.

The mineral breaker 12 acts to break down large lumps of mineral contained in the feed mineral and deposits broken mineral and fines onto the takeaway conveyor 14. The takeaway conveyor 14 transports the mineral discharge received from the mineral breaker 12 to its discharge end 15 whereat the mineral discharge is conveniently discharged onto a further takeaway conveyor (not shown) for transport to a stock pile.

The rig 10 comprises a load carrying chassis 20 which basically comprises an inclined section defined by a housing 21 surrounding the feed conveyor 11, an elevated section defined by a pair of main support beams 23 and ground engaging support pillars 24. As seen in the drawings, a pair of ground engaging support pillars 24 are provided connected to a respective support beam 23. The support pillars 24 are rigid, ie. in-extensible and so are able to carry substantial loads without collapse. The housing 21 has a lower end section 27 which in use is adapted to engage the ground.

Accordingly, the chassis 20 is rigid throughout and, in use, sits on the ground at three locations, viz. at end section 27 and at the pair of pillars 24. This three point contact with the ground is preferred, but it is appreciated that more points of contact with the ground may be provided if necessary, for example, additional support pillars 24 may be provided.

Since the end section 27 extends transversely of the apparatus 10, it provides a relatively large ground engaging area or footprint for dissipating loads.

It will be appreciated that support beams 23 constitute an elevated section of the chassis 20 which is supported above the ground by the inclined section defined by housing 21 and support pillars 24; the elevated chassis section constituting a support for the mineral breaker 12.

Preferably the inclined section is inclined to the horizontal by an angle less than about 30°, preferably about 20°.

The housing 21 is of a modular construction comprising two side housing bodies 30, 31 and an end housing body 33 which defines the ground engaging end section 27. Each housing body 30, 31 and 33 is fabricated from steel girders and plate to define a hollow tunnel-like interior suitable for a person to walk along. The inner wall of each housing body which faces inwardly toward the conveyor 11 is preferably open to permit inspection and maintenance operations to be performed.

Fabrication of each housing body 30, 31 and 33 is such that each body acts as part of the chassis 20 and so is load bearing. The size of each housing body 30, 31 and 33 is such as to enable it to be easily transported from a point of manufacture to the point of assembly on site.

Each side body 30, 31 is secured at one end to the end body 33 preferably by bolts. The opposite end of each side body 30, 31 is secured to a respective one of the support beams 23 preferably by bolts. Similarly each support pillar 24 is preferably secured to respective support beams 23

by bolts. Accordingly, it will be appreciated that the main components of the chassis 20, viz. bodies 30, 31, 33; beams 23 and support pillars 24 may be easily assembled on site.

It will be appreciated that the chassis 20 as defined by the connected bodies 30, 31, 33 and beams 23 is basically U-shaped in plan (see for example Figure 7) having a central longitudinal axis LA.

In order to provide rigidity laterally of the chassis 20 (ie. in a direction perpendicular to the longitudinal axis LA as viewed in Figure 7) the inner sides 36 of the side bodies 30, 31 are secured, preferably by bolts, to the frame structure 111 of the feed conveyor 11.

In addition, the mineral breaker 12 is preferably utilised to provide a bracing connection between the pair of support beams 23. In this respect, the breaker 12 includes a housing 112 which is fabricated to be of a strong box-like structure, preferably rotatably housing a pair of breaker drums 116.

A suitable mineral breaker is described in our European patent 0114725 or UK patent 2170424.

Preferably the mineral breaker comprises a pair of rotatable breaker drums having opposed breaker teeth which are arranged in discrete helical formations so as to break mineral by applying tensile loadings, ie. by a snapping action.

Such a mineral breaker is capable of handling large throughput tonnages despite being relatively small in size. Due to the breakage action and

arrangement of the opposed breaker drums, the frame of the mineral breaker is not exposed to excessive vibrations during operation and contains within the frame, all the reactive forces arising from the breaking action.

Accordingly, the frame of such a mineral breaker is ideally suited for siting on the elevated section of the chassis 20 and is ideally capable of use as a bracing member between the beams 23.

Due to the relative compact size of the breaker 12, it is easily transported as a modular unit (ie. ready assembled) for mounting onto the chassis 20 on site.

Additional braces (not shown) may be provided for rigidly connecting the beams 23 together may be provided if necessary. It is however preferred to rely upon the housing 112 of the mineral breaker 12 as the main brace between the support beams 23.

Located beneath the main support beams 23 is a mobile transport unit 50.

The transport unit 50 includes a chassis 51 which is basically square shaped in plan (see Figure 10) comprising a pair of end beams 52 which extend in the transverse direction relative to the apparatus 10 and which are interconnected by two pairs of side beams 56. Side beams 56 are manufactured as fabricated modular units from steel plate and beams.

Each end beam 52 is preferably constructed so as to be a unitary component. Each beam 52 is preferably secured to respective side beams 56 by bolts.

Accordingly, end beams 52 and side beams 56 may be easily transported from the point of manufacture as modular units and easily assembled on site.

The chassis 51 carries a pair of self propelled track units 57. Track unit 57 includes a main support beam 58 having track wheels 59 at opposite ends and about which a continuous track 60 runs. Preferably one of the wheels 59 is a sprocket drive wheel for driving the track. A hydraulic motor 61 is provided for driving the drive sprocket wheel.

Preferably each beam 52 is provided at each end with a connection formation 65 which engages the top and inner side of the main support beam 58. Preferably the connection formation is secured to the main support beam 58 by bolts.

Accordingly, each track unit 57 may be transported separately and assembled onto the chassis 51 on site.

The side beams 56 of each pair are spaced apart from one another and together with the end beams 52 define a guide channel 70.

As seen in Figures 10 and 11 on both sides of each channel 70, hydraulic rams 72 are mounted on respective side beams 56. Preferably the cylinder housing 73 of each ram is supported on the side beams 56.

The transport unit 50 is connected to the elevated section of the chassis 20 by means of a pair of guide pillars 80 each of which is secured, preferably by bolts, to the underside of a respective main support beam 23, each

guide pillar 80 being telescopically received within a respective guide channel 70.

The heads 77 of each ram 72 is located within a respective bracket 78 which is secured, preferably by bolts to the underside of a respective main beam 23. In Figure 9, the left hand bracket 78 is illustrated detached from the beam 23. It is conveniently secured in position by raising of the ram to move the bracket 78 into contact with beam 23 and then bolted in position as shown for the right hand bracket 78.

The position of the mobile track unit in the longitudinal direction LA can therefore be easily adjusted by detaching the brackets 78 and guide pillars, moving the unit longitudinally and re-attaching the brackets 78 and guide pillars. This adjustment of position conveniently enables the mobile track unit to be sited close to the centre of gravity of the apparatus along longitudinal axis LA.

Each pillar is preferably fabricated from steel plate and is manufactured to close outside dimensional tolerances. Preferably packing strips 88 are located internally of each guide channel 70 at each corner and serve as slide bearing strips for engaging the sides of each respective pillar during telescopic movement of the pillar relative to the guide channel.

Preferably the clearance gap between opposed faces of each pillar and packing strips 88 is relatively small, typically 1-2 mm. Accordingly, each pillar is positively guided within its respective guide channel 70 and this reduces the likelihood of jamming. This is important bearing in mind that typically the apparatus (excluding the transport unit 50) may weigh up to 350 tons.

The telescopic adjustment is such that the track units may be moved between a fully retracted position whereat the tracks are lifted clear of the ground and a fully extended position whereat the chassis 20 is lifted clear of the ground. The maximum amount of ground clearance for chassis 20 is chosen bearing in mind the ground conditions likely to be encountered. Typically the maximum ground clearance is chosen to be about 800 mm.

When the apparatus is operating in a quarry or open cast mine, it will normally be seated upon its chassis 20 and will remain in this position for a long period of time. Since the track units are raised from the ground during this time, it is possible to run the tracks whilst raised and thereby maintain them in good running order.

To move the apparatus to another location in the quarry, the transport unit is lowered to raise the chassis 20 clear of the ground and the transport unit is then driven to move the apparatus to a new location.

As will be appreciated from the above, the transport unit 50 is connected to the elevated section of the chassis 20 and so is located within all the ground contacting regions of the chassis 20; viz. it is located internally with respect to the ground engaging lower end section 27 of housing 21 and the support pillars 24.

Accordingly, whilst the chassis 20 is clear of the ground and being moved to the new location, the ground contacting regions of the chassis 20 can act as stabilisers to prevent the entire rig tipping over should it be moved over very uneven or soft ground. Should one of the ground contacting

regions contact the ground to prevent tipping, then it may be subsequently raised clear of the ground by operating lifting rams 72.

A cab 90 for an operative is conveniently located above the mineral breaker.

Operating platforms 92 for carrying ancillary service equipment such as engines for powering the mineral breaker, hydraulic power units, etc are preferably mounted on the elevated section of the chassis 20.

The weight distribution of the ancillary equipment and platforms 92 is preferably designed such that the centre of gravity of the apparatus is located as close as possible to the longitudinal axis LA.

The apparatus may be conveniently converted for the receipt of feed mineral by different conventional techniques encountered in open cast mining. This is achieved by providing the feed conveyor 11 with the appropriate type of hopper structure.

For example, in Figure 4 the hopper structure 150 shown is suitable for deposit of mineral from bucket loading vehicles. In Figure 3, the hopper structure 160 is suitable for the deposit of mineral from loading trucks which deposit mineral from an elevated platform 161.

A second embodiment 200 is illustrated in Figures 13 to 15 wherein parts similar to those in the first embodiment have been designated by the same reference numerals.

In embodiment 200, a hopper structure for feed conveyor 11 has been dispensed with. Instead a natural hopper is built in the surrounding ground such that the rear of the apparatus 200 is in effect buried. To prevent spillage of material forming the natural hopper, ie. in order to maintain the integrity of the hopper, retaining plates 220 are provided. The plates 220 are secured to the chassis 20 and also shield the rear end of the track units.

As seen in both embodiments, the end section seated on the ground also includes a pair of support feet 13 secured beneath the side bodies 30, 31. The support feet 13 preferably have inclined side walls 113 facing the track units. These side walls 113 act as skids which assist in raising the end section free of the ground by driving the transport unit in a forwards direction.

In the second embodiment 200, the support pillars are connected to the main support beams 23 so as to be spaced apart by a distance greater than the width of the transport unit. This has the advantage of enabling the transport unit to be driven underneath the elevated section of the chassis 20 from the front of the apparatus.

Accordingly, if desired, once the apparatus has been sited at a desired location, the transport unit 50 may be detached from the elevated section of the chassis 20 and driven away leaving the apparatus as a static free standing apparatus.

CLAIMS

1. A mineral breaking apparatus including a rigid support chassis having an elevated section supported above the ground by at least three ground contacting regions, the apparatus including a mineral breaker mounted on said elevated section and a feed conveyor for feeding mineral to be broken to the mineral breaker, the chassis including an inclined section having a lower end and an upper end, the lower end being adapted to define one of said at least three ground engaging regions and the upper end being connected to said elevated section, said elevated section defining a support for said feed conveyor, and at least two ground engaging feet mounted on the elevated section to define two of said ground contacting regions.

2. Apparatus according to Claim 1 wherein the chassis is basically U-shaped.

3. Apparatus according to Claim 1 or 2 wherein the inclined section of the chassis comprises a hollow housing defining a personnel passageway surrounding the feed conveyor.

4. Apparatus according to Claim 3 wherein the inclined section of the chassis is assembled from modular units comprising sections of said hollow housing.

5. Apparatus according to Claim 1, 2, 3 or 4 wherein the elevated section of the chassis is defined by elongate support beams.

6. Apparatus according to any preceding claim including a mobile transport unit mounted to and located beneath the elevated section of the chassis of the mobile transport unit having ground engaging tracks or wheels, the transport unit including lifting means connected to the chassis for raising the chassis clear of the ground.

7. Apparatus according to Claim 6 wherein the mobile transport unit is telescopically connected to the elevated section and the lifting means is arranged to lift the ground engaging tracks or wheels clear of the ground.

8. Apparatus according to any preceding claim wherein the mineral breaker comprising a pair of mineral breaker drums rotatably mounted in a frame.

9. Apparatus according to Claim 9 wherein the frame of the mineral breaker is attached to the elevated section of the chassis to form a structural part of the chassis.

10. Apparatus according to any preceding claim including a take-away conveyor mounted on the elevated section of the chassis and arranged to receive mineral being discharged from the mineral breaker.

11. A rigid support chassis for a mineral breaker rig, the chassis having:

an elevated chassis section;

an inclined chassis section for supporting a feed conveyor;

the elevated chassis section being supported above the ground by the inclined chassis section and by at least 2 ground contacting regions spaced from said inclined section, and

the inclined chassis section being assembled from elongate hollow housings joined together end to end to define a personnel passageway extending around the feed conveyor.

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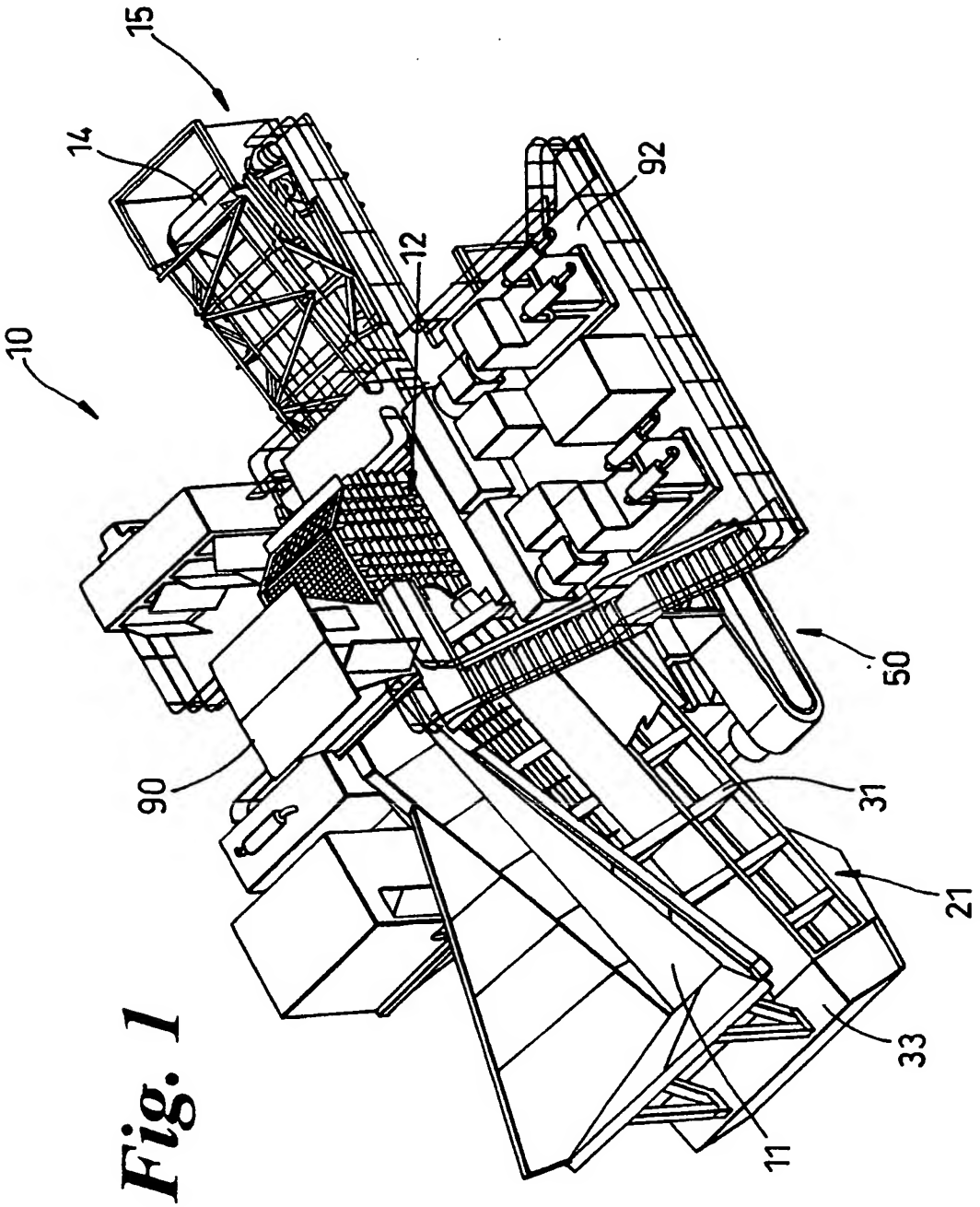


Fig. 1

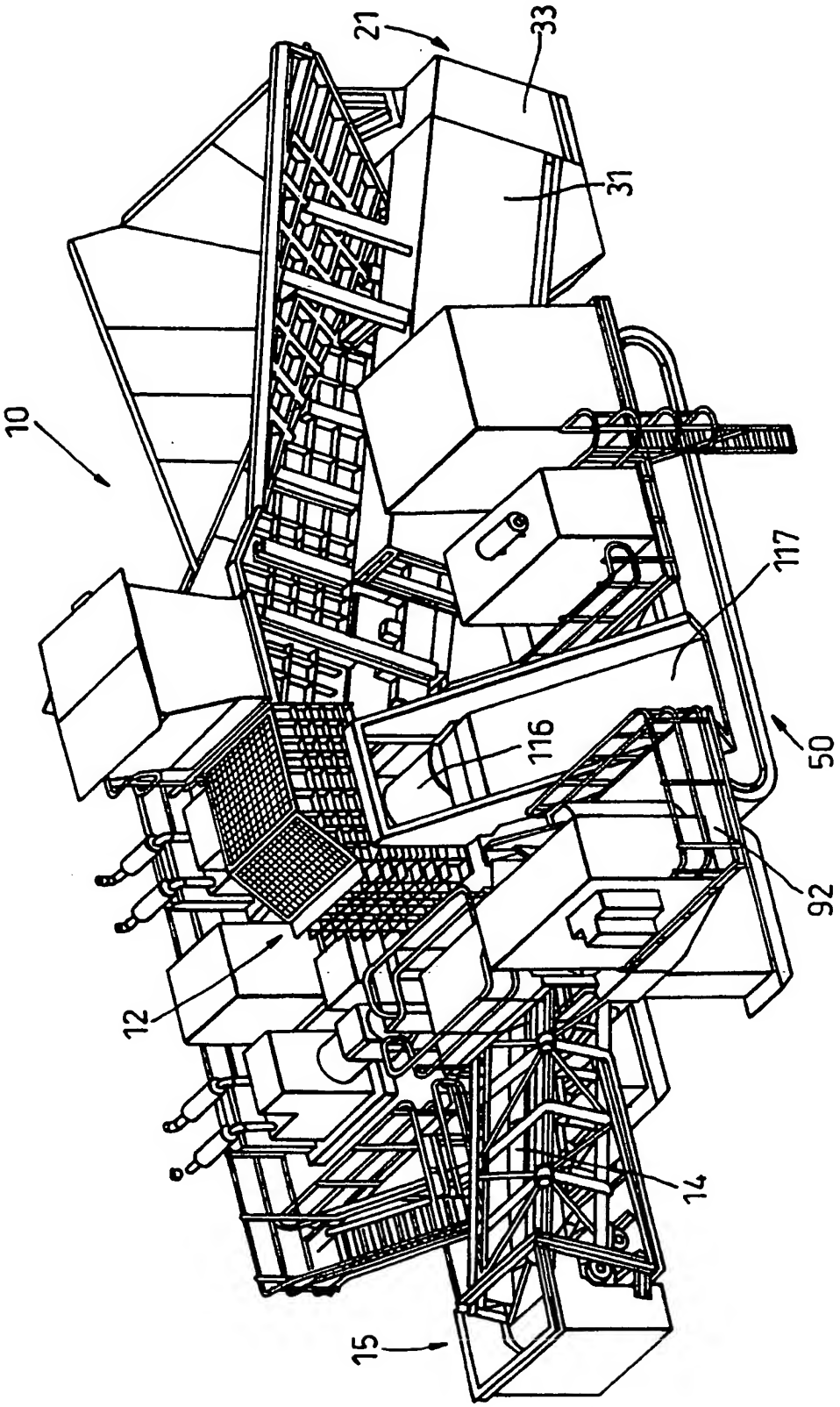


Fig. 2

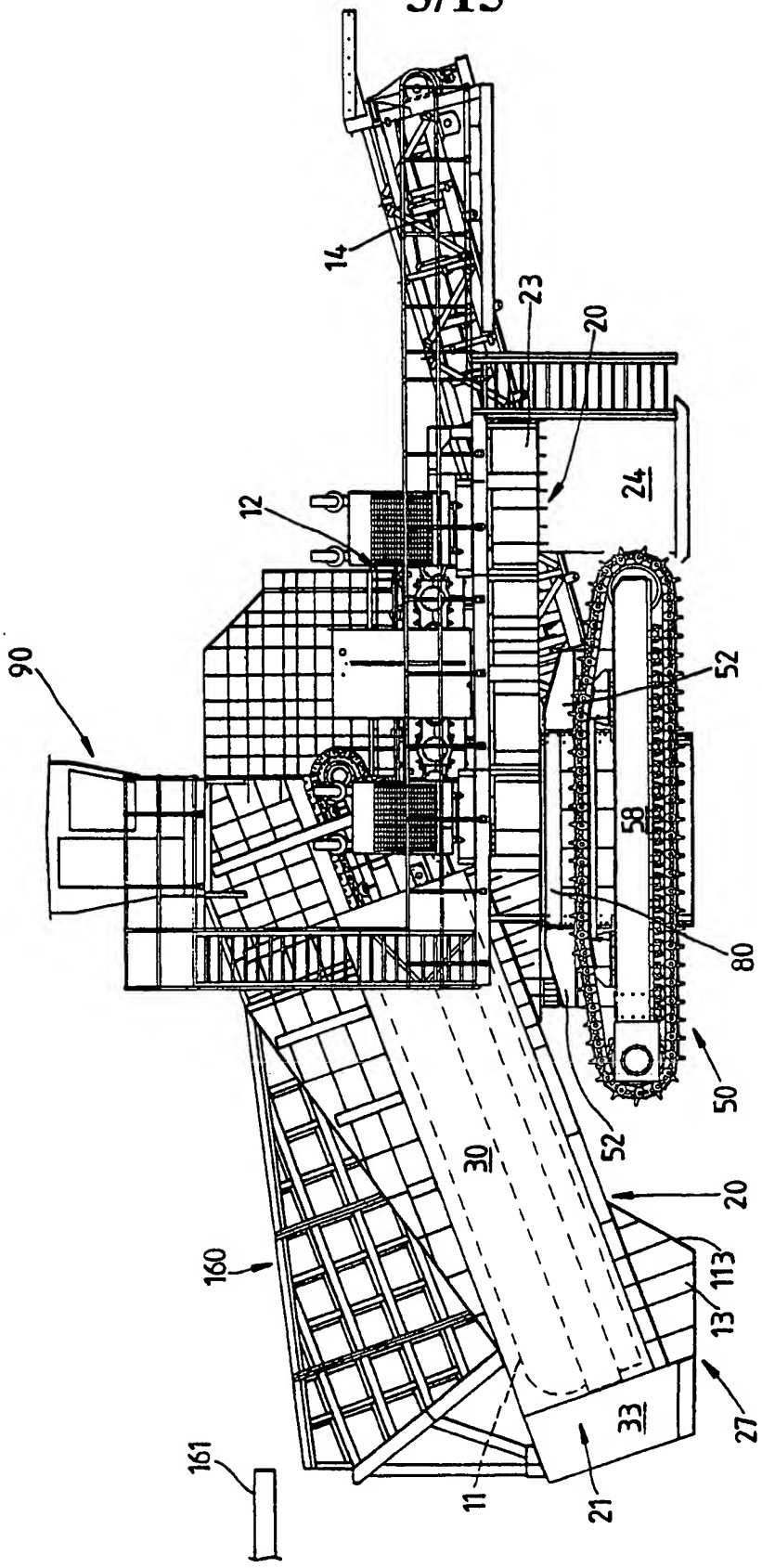


Fig. 3

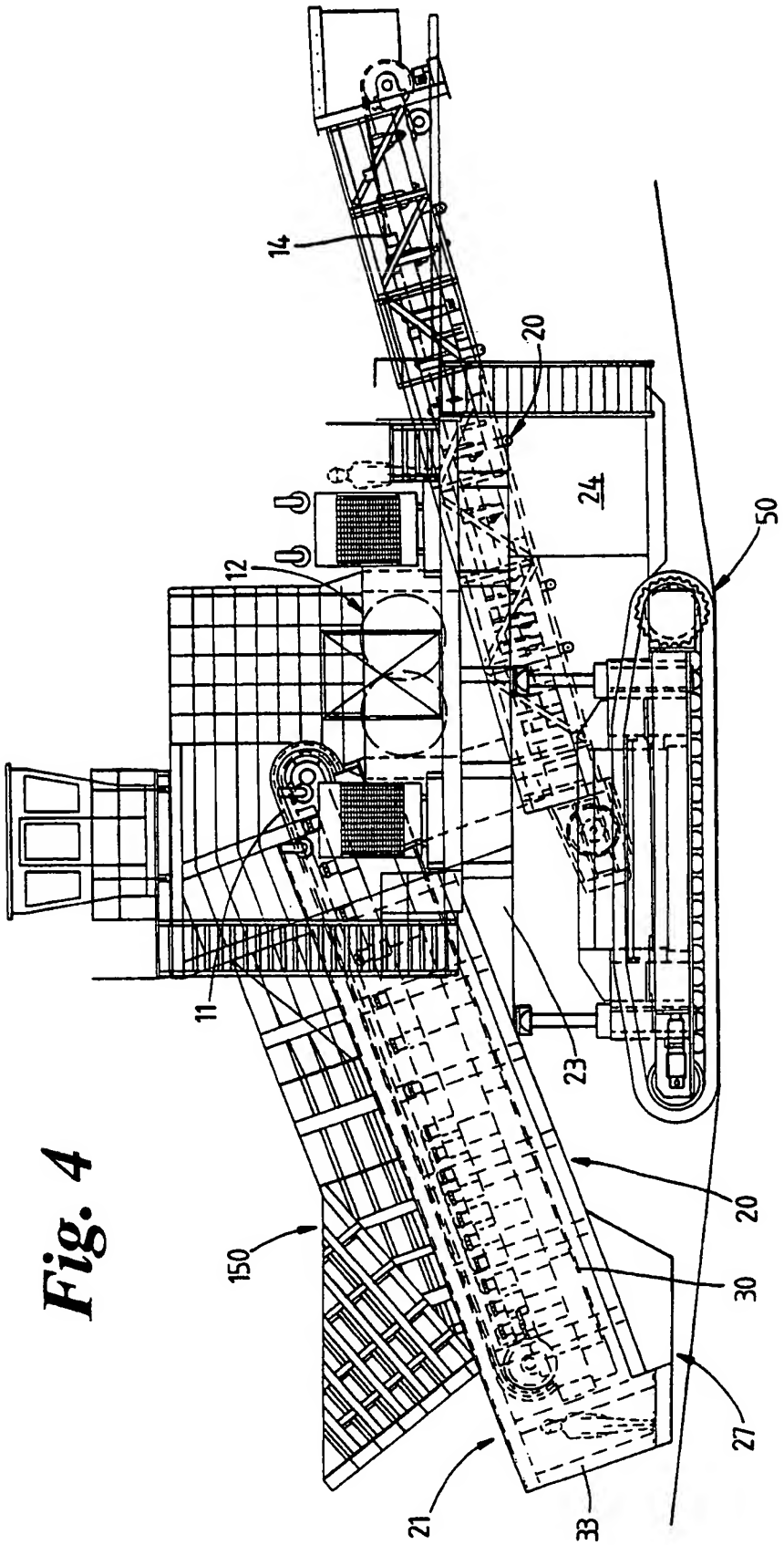


Fig. 4

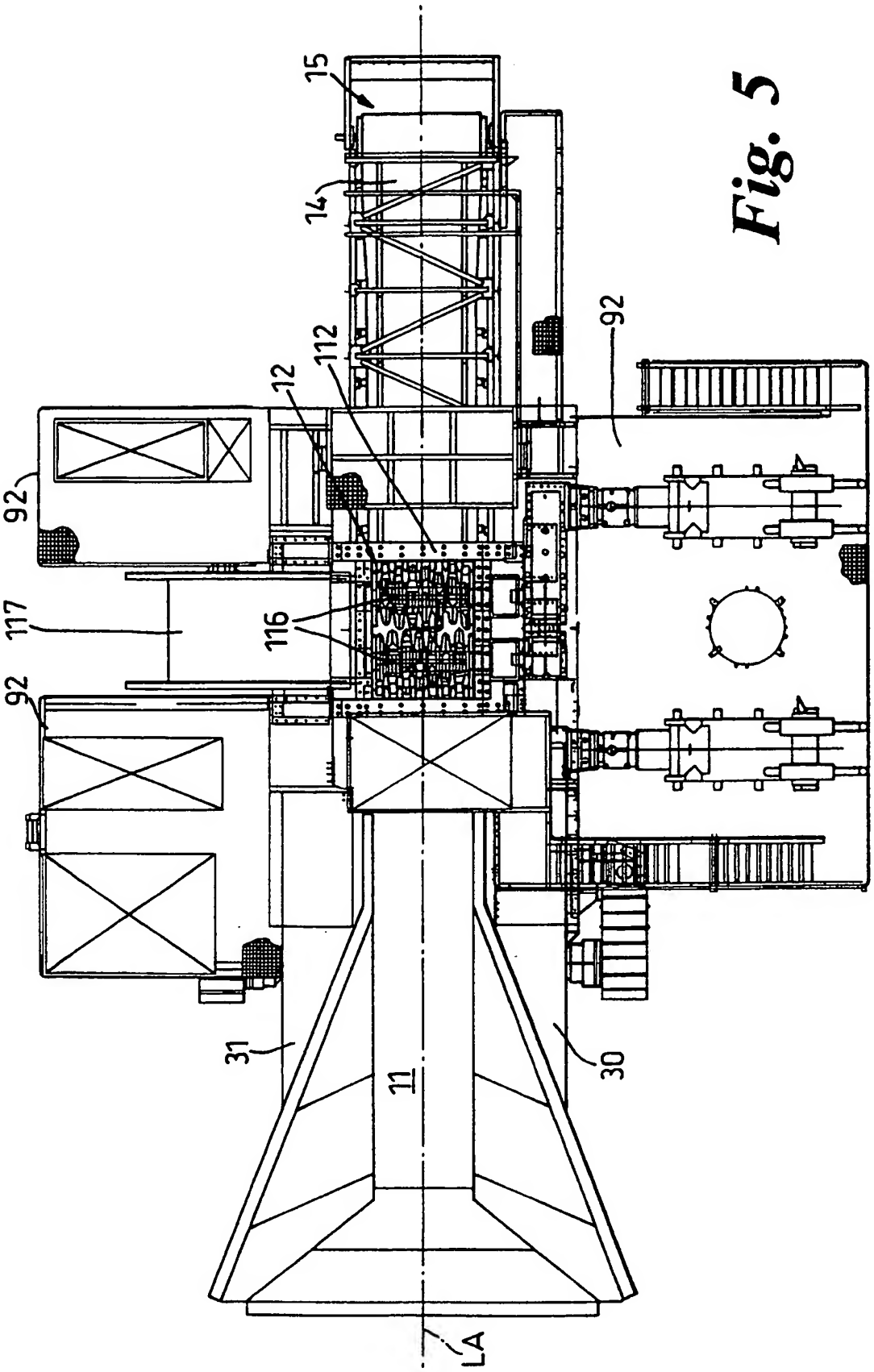


Fig. 5

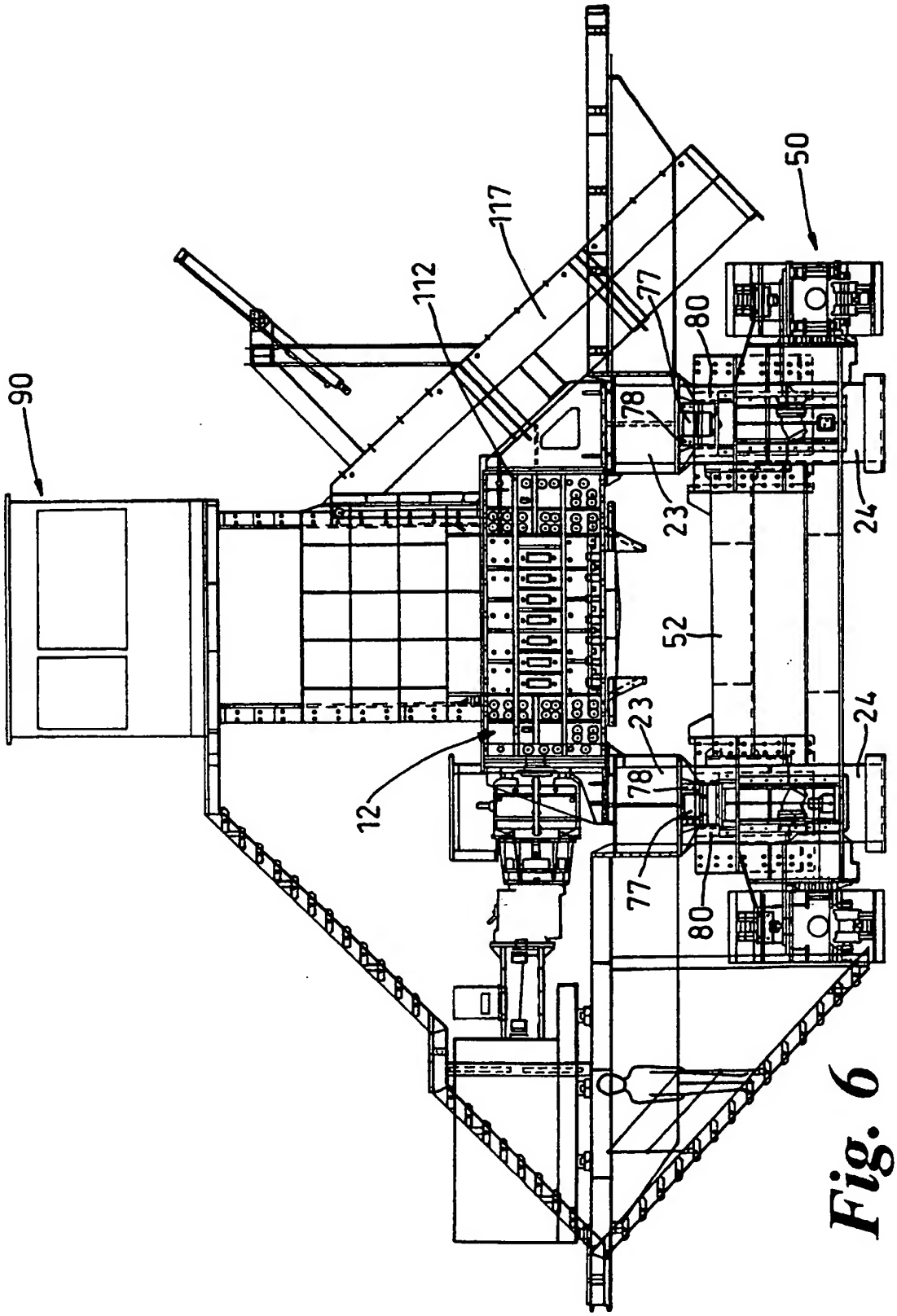


Fig. 6

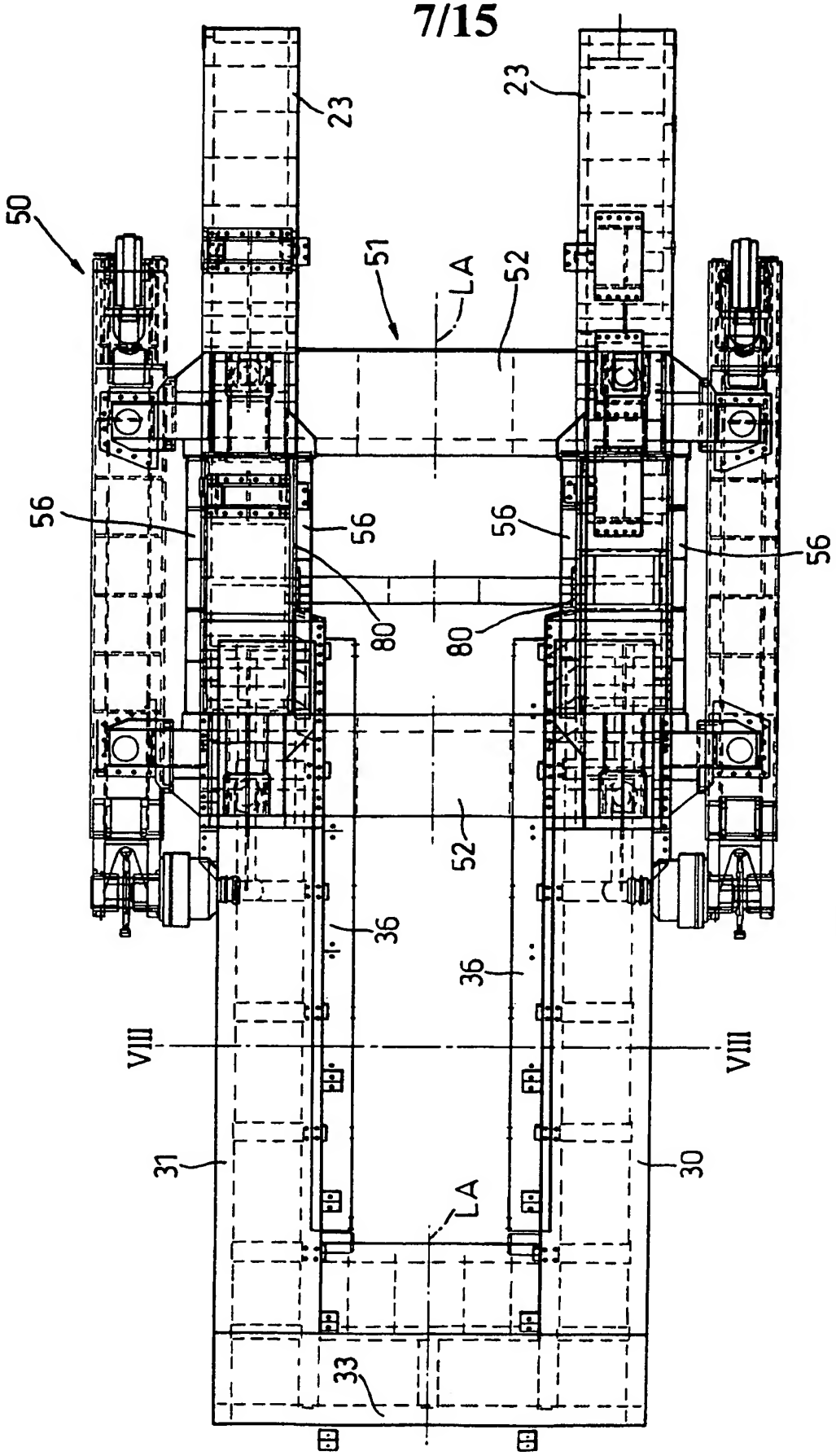


Fig. 7

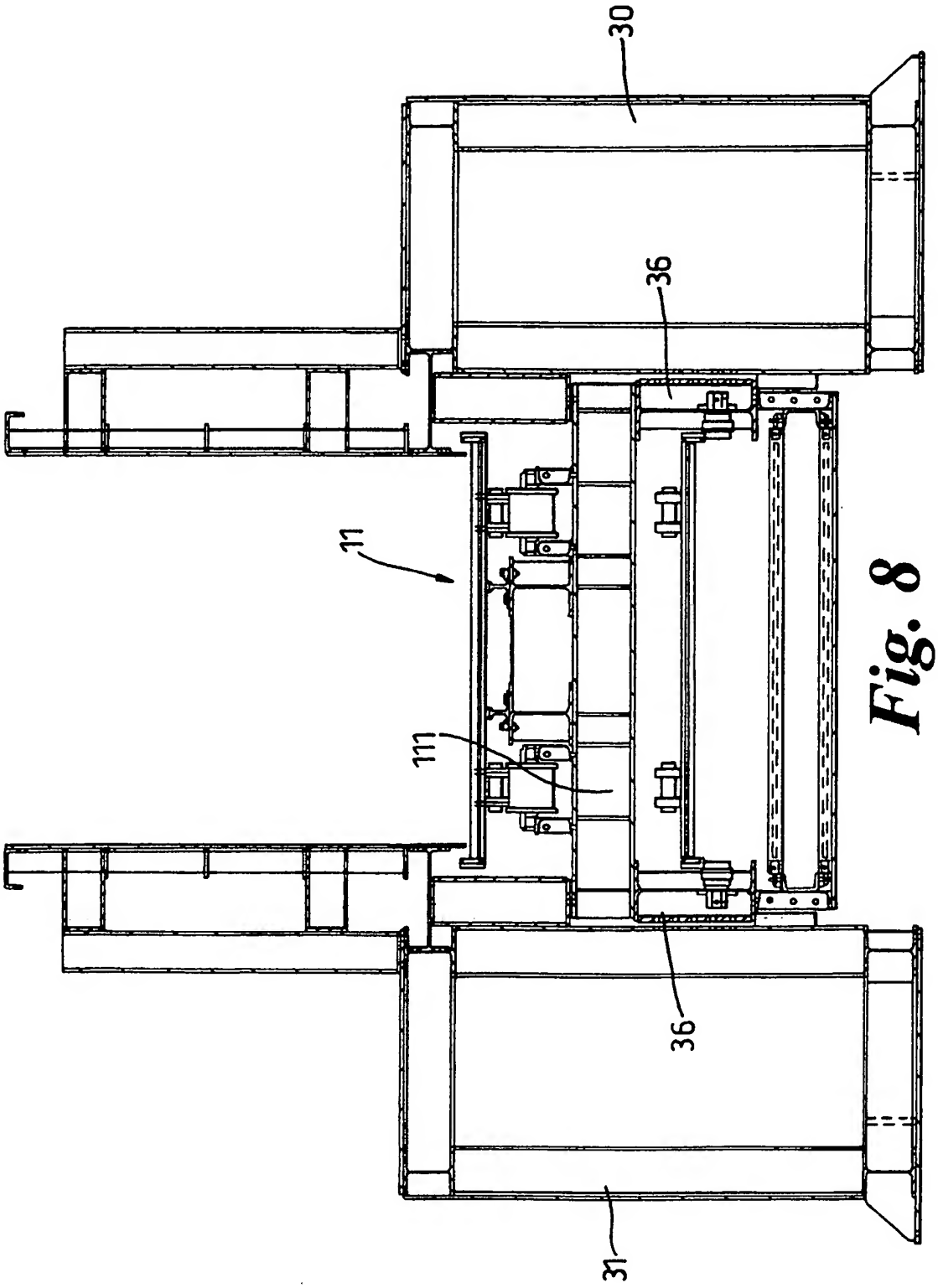


Fig. 8

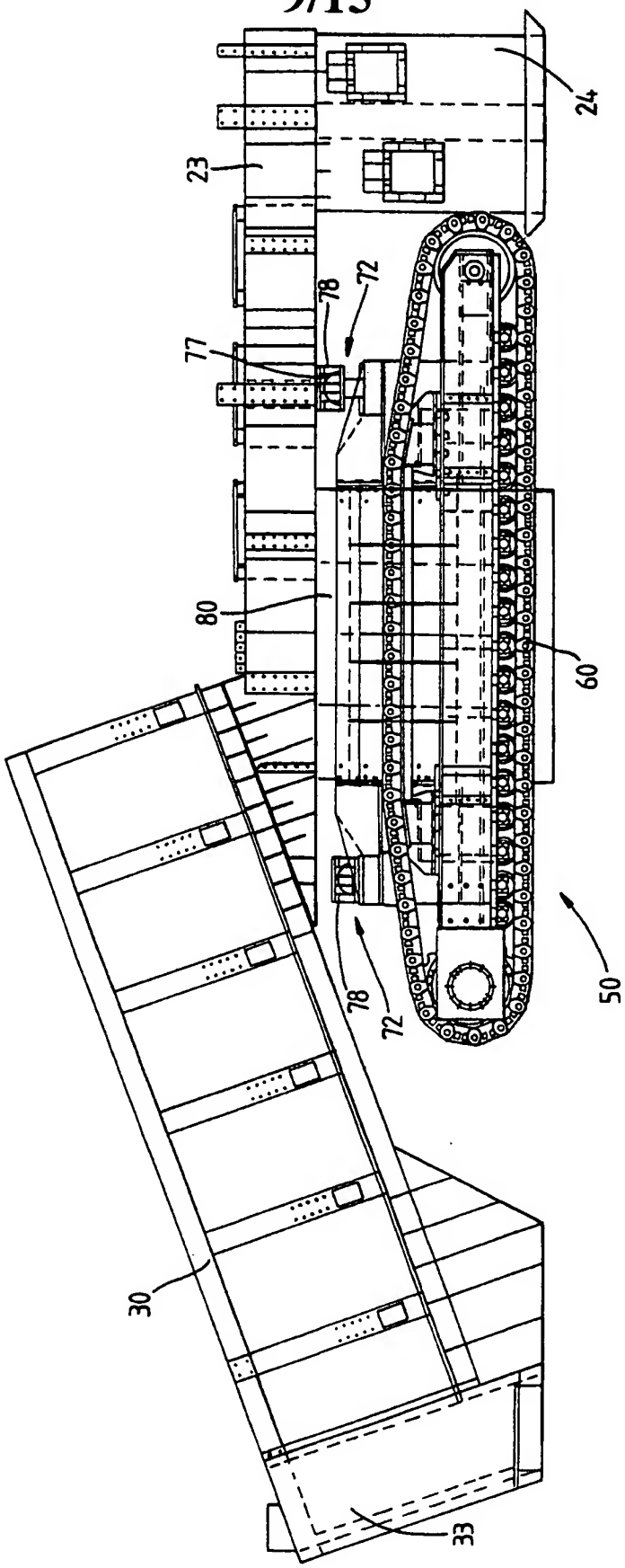
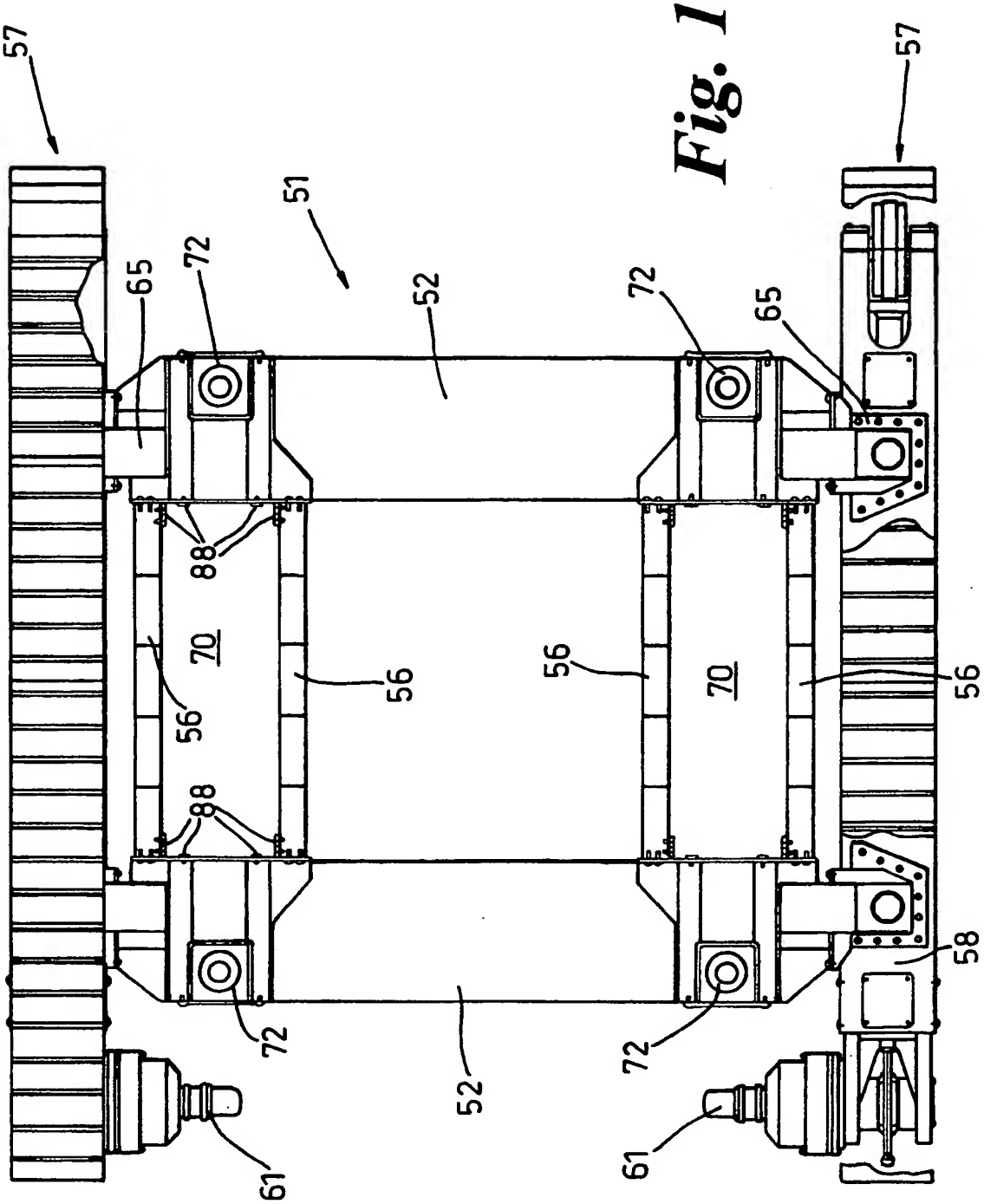


Fig. 9

Fig. 10



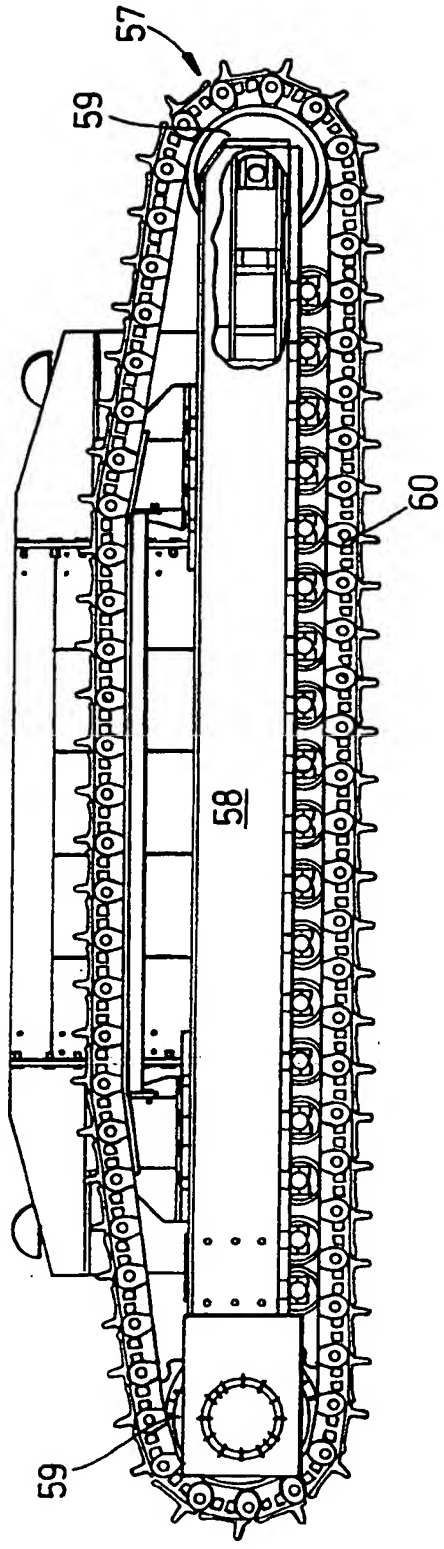


Fig. 11

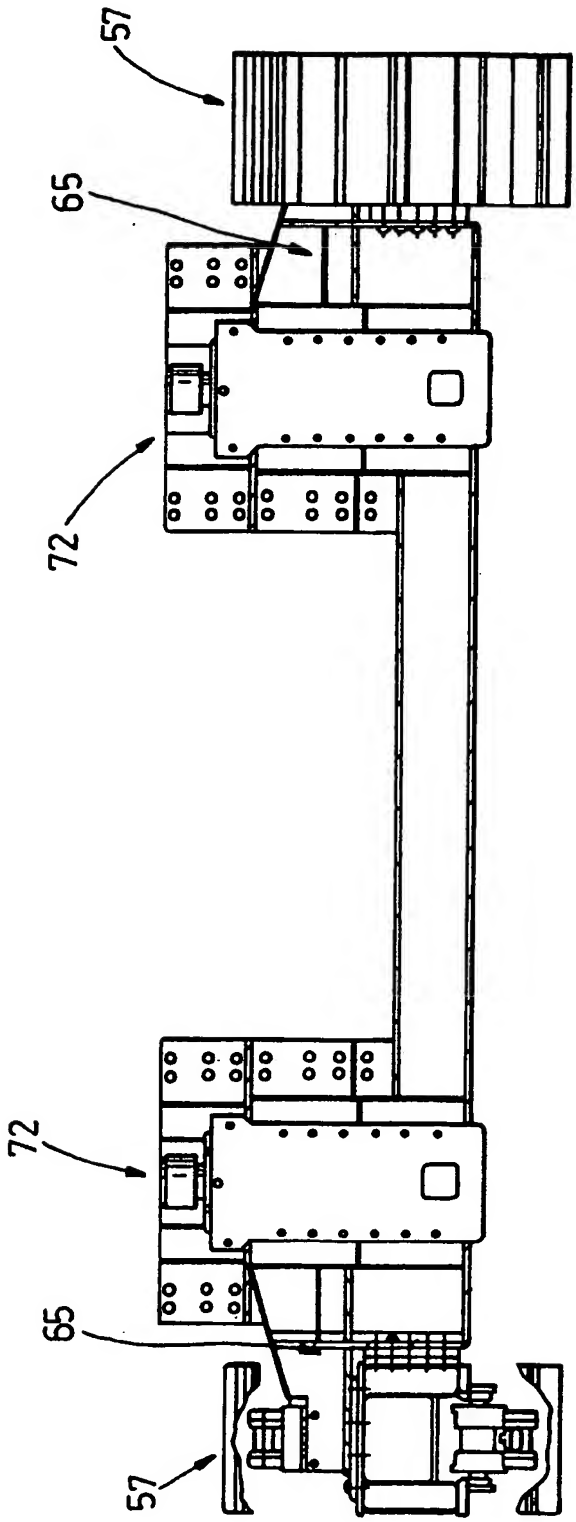
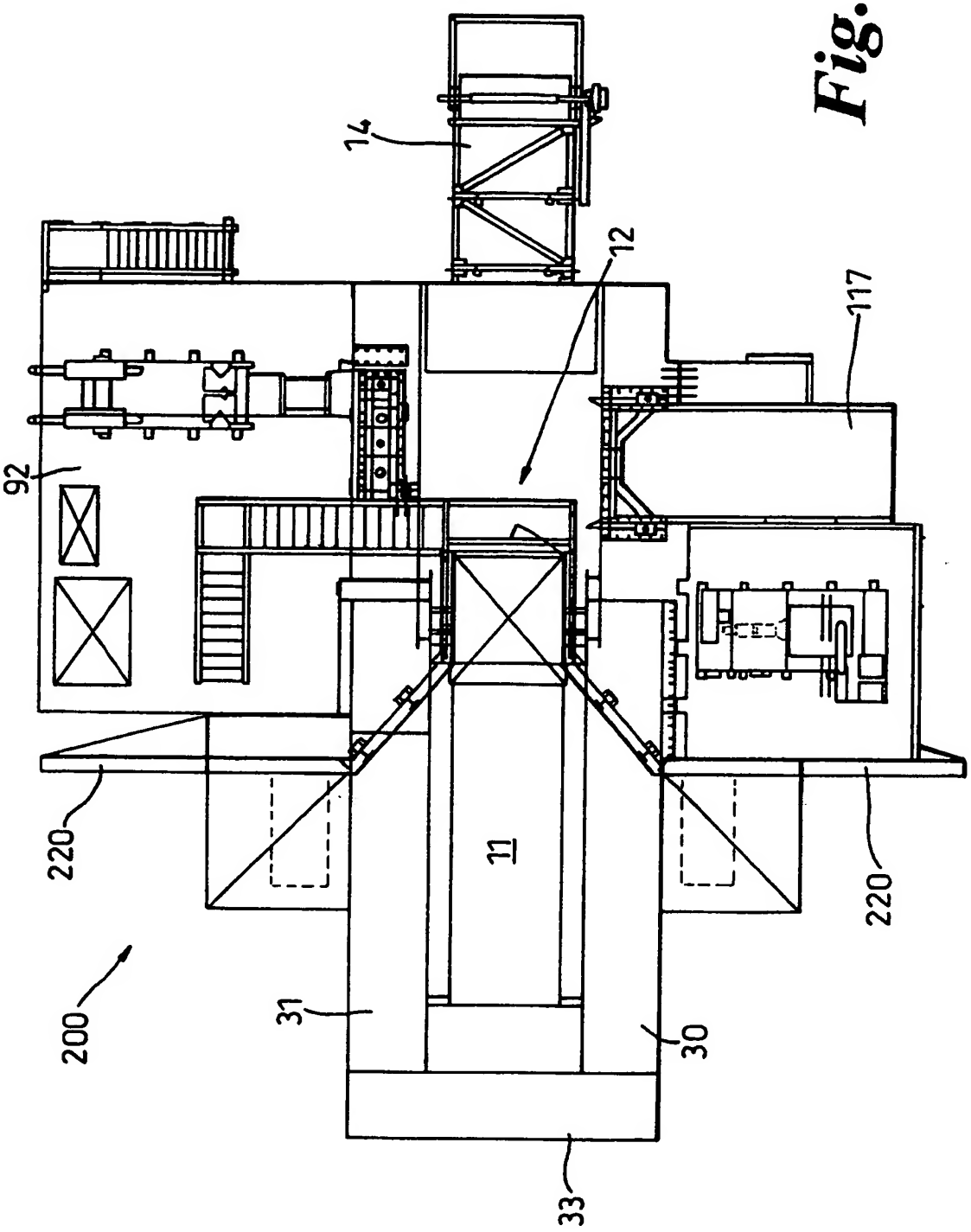


Fig. 12

Fig. 13



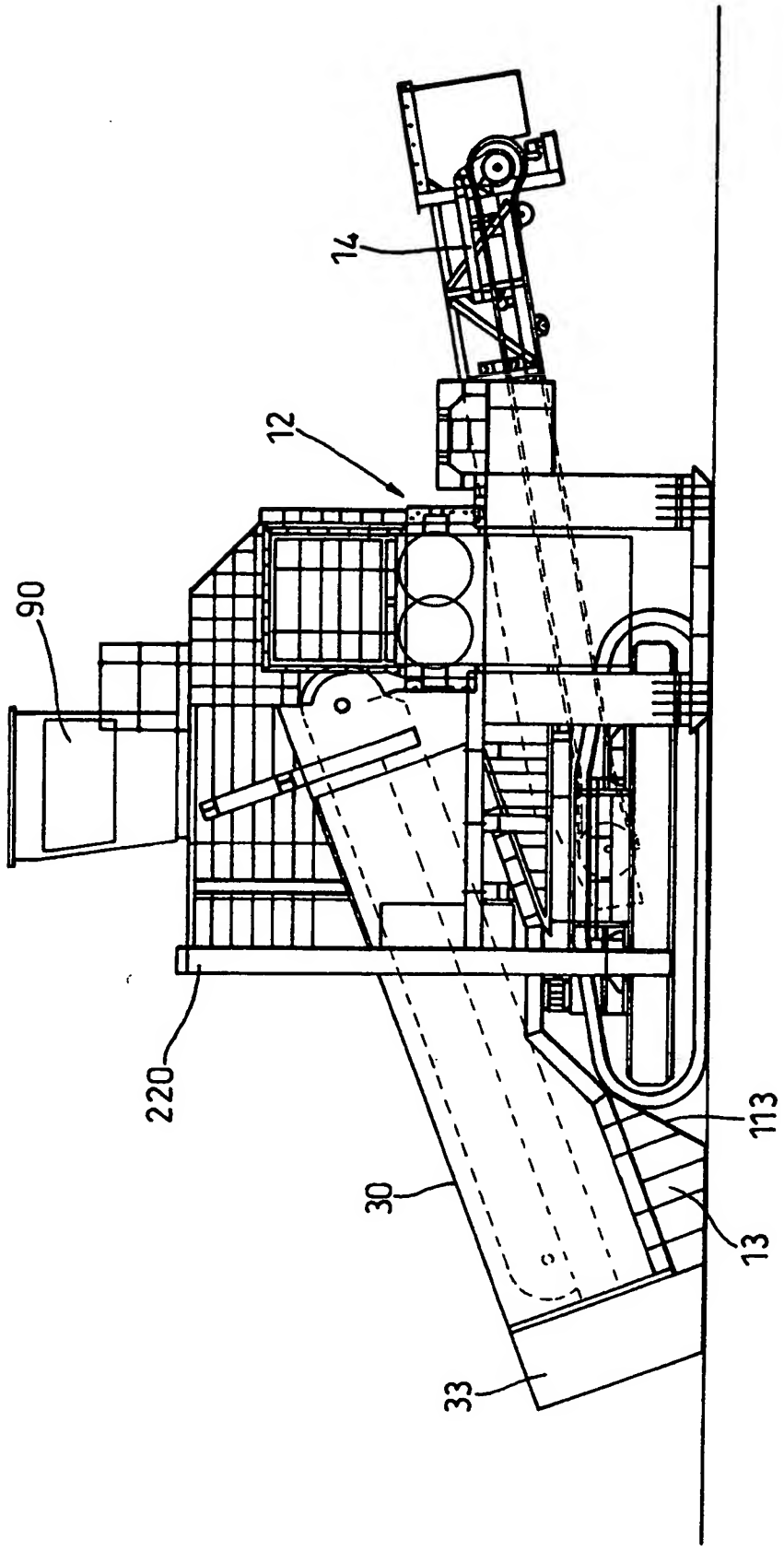


Fig. 14

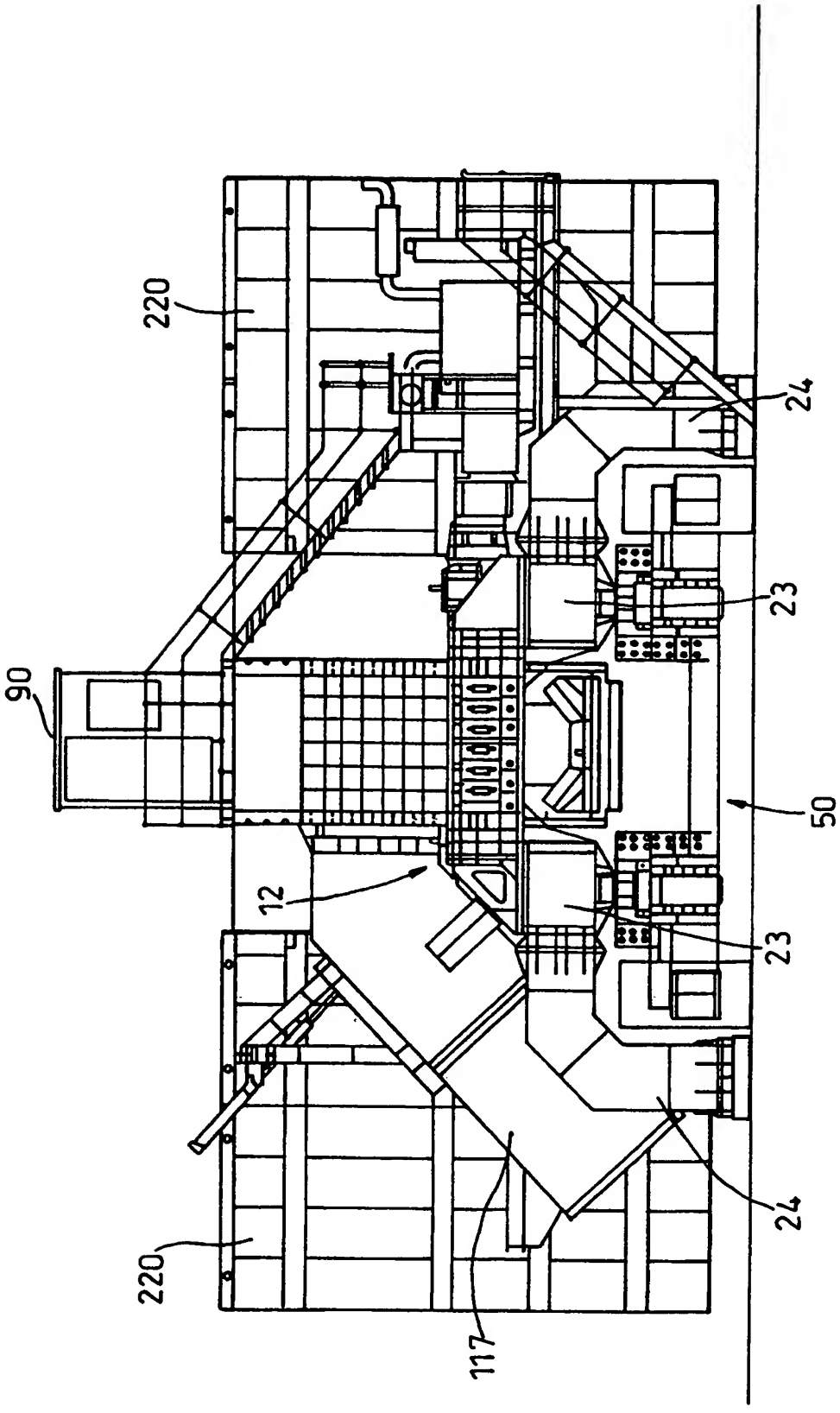


Fig. 15

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 99/01210

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B02C21/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B02C E21C E02F E01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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12 July 1999	21/07/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Verdonck, J

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INTERNATIONAL SEARCH REPORT

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